

## appendix **B**

# Sensitivity to Low Dissolved Oxygen Concentrations for Northern and Southern Atlantic Coast Populations of Selected Test Species

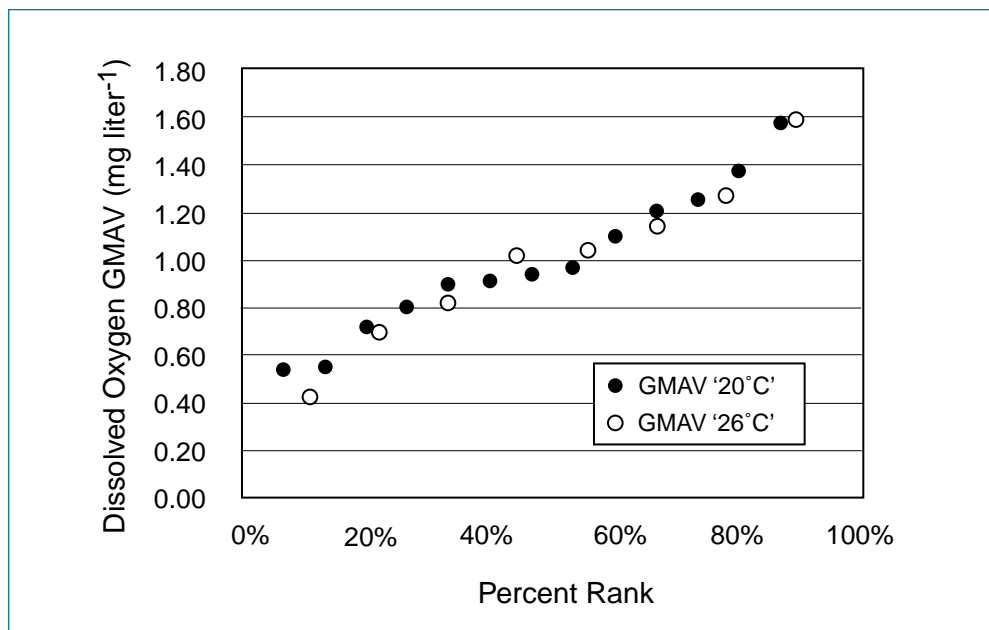
This appendix provides the following lines of evidence to support the conclusion that the data used in the calculation of the Virginian Province saltwater dissolved oxygen criteria (U.S. EPA 2000) are appropriate for the Chesapeake Bay dissolved oxygen criteria development.

For the juvenile criterion (Final Acute Value), most test temperatures ranged from 19°C to 30°C. Three species were tested at temperatures less than 19°C: *Homarus americanus* (15°C), *Carcinus maenas* (10°C) and *Rithropanopeus harrisii* (10°C). Fourteen genera were tested at 19°C to 21.5°C and eight genera were tested at 23°C to 30°C. Figure B-1 shows the cumulative rank plot for genus mean acute values (GMAV) using data from Appendix B of the Virginian Province saltwater dissolved oxygen criteria document (U.S. EPA 2000). The data were segregated into '20°C' and '26°C' groups, representing the 14 and 8 genera groups mentioned above, respectively. Plots of the two sets of data overlap, showing that both groups give a similar estimate of the range for the juvenile community's sensitivity to hypoxia. The criteria minimum concentrations (CMC) calculated for the two sets of data are likewise very similar, 2.36 mg/L for the '20°C' group, and 2.26 mg/L for the '26°C' group.

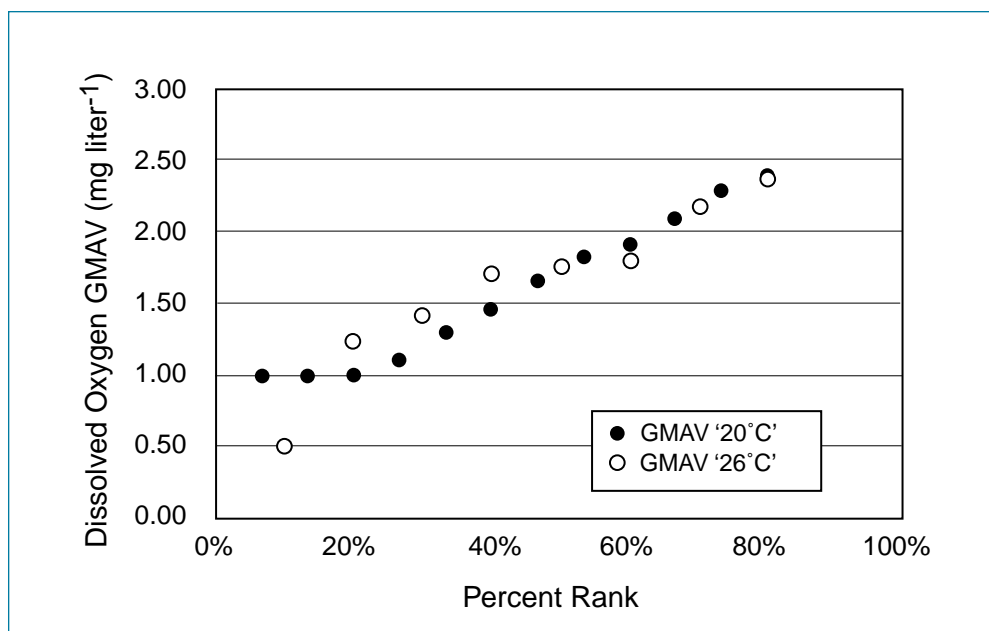
The same type of analysis was conducted using the 24-hour larval LC<sub>50</sub> data (lethal concentration at which 50 percent mortality of the test organisms was observed) from Appendix D of the Virginian Province document (Figure B-2; U.S. EPA 2000). The temperature ranges were also similar, 18°C to 22°C for the '20°C' group, and 23°C to 30°C for the '26°C' group. There were 14 genera in the former and 9 genera in the latter. The conclusion is the same for larvae as for juveniles, a similar distribution of community sensitivity to hypoxia for both sets of temperatures.

In addition to the data from the Virginian Province document, the EPA has conducted tests comparing the sensitivity to hypoxia for northern and southern populations of two invertebrates (the mud crab, *Dyspanopeus sayi* and the grass shrimp, *Palaemonetes vulgaris*, larvae for both species) and one fish (the inland silverside, *Menidia beryllina*, juveniles and larvae; Thursby, personal communication). All of the northern populations were from Rhode Island. The southern populations of

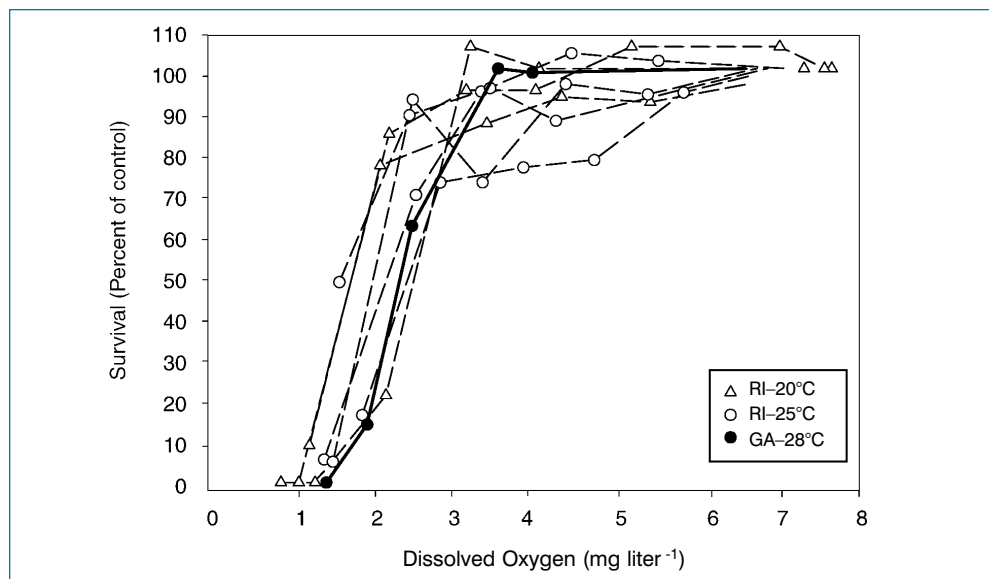
invertebrates were from Georgia, and the fish were from Florida. The exposure response data are shown in figures B-3 through B-6. The northern and southern populations of each species responded similarly to low dissolved oxygen conditions, even though they were conducted at different temperatures.



**Figure B-1:** Plot of juvenile genus mean acute values (GMAVs) against percent rank. Data are from Appendix B in the Virginian Province saltwater dissolved oxygen criteria document (U.S. EPA 2000).

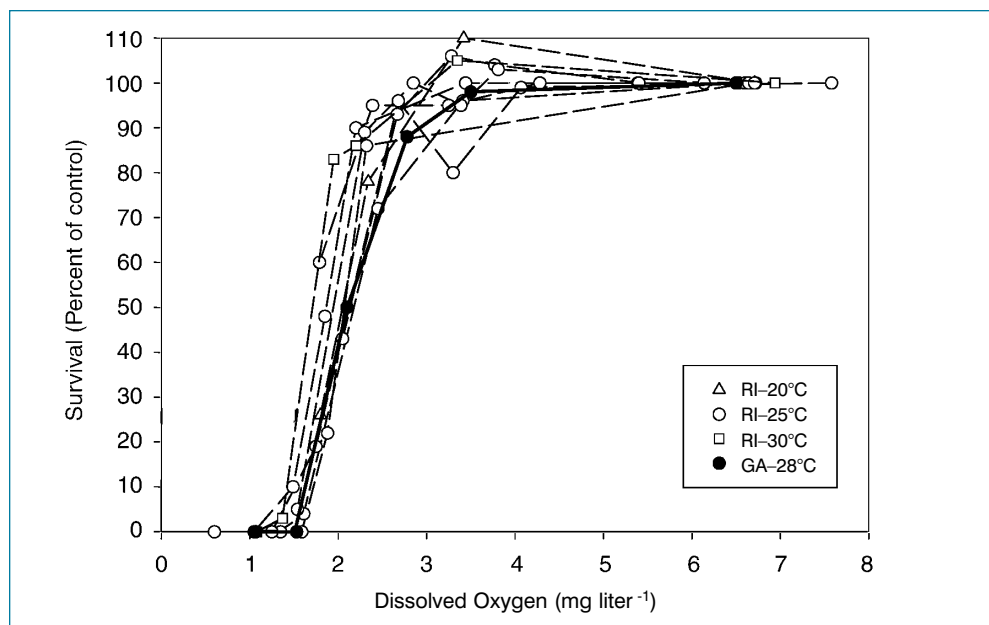


**Figure B-2:** Plot of larval genus mean acute values (GMAVs) against percent rank. Data are from Appendix D in the Virginian Province saltwater dissolved oxygen criteria document (U.S. EPA 2000).



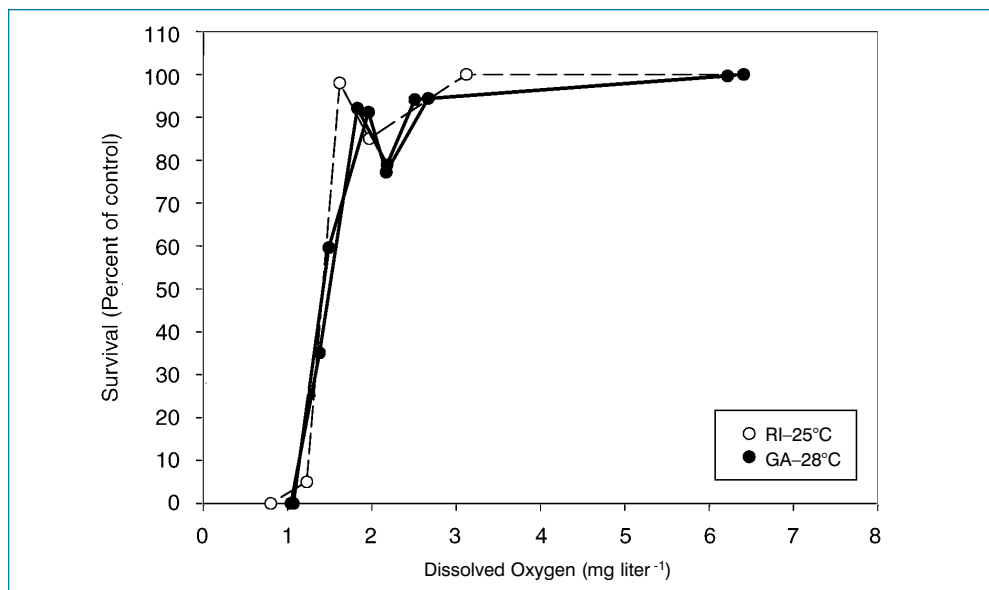
**Figure B-3.** Ninety-six hour dose-response for larvae of the marsh grass shrimp *Palaemonetes vulgaris* exposed to various levels of low dissolved oxygen. Open symbols are for tests conducted with populations from Rhode Island (RI) (three at 20°C and four at 25°C). The closed circles are data for a population from Georgia (GA) conducted at 28°C. All of the RI data are from tests included in the Virginian Province saltwater dissolved oxygen criteria document and are listed in Poucher and Coiro (1997). Tests were initiated with larval less than 24 hours old.

Source: U.S. EPA 2000.



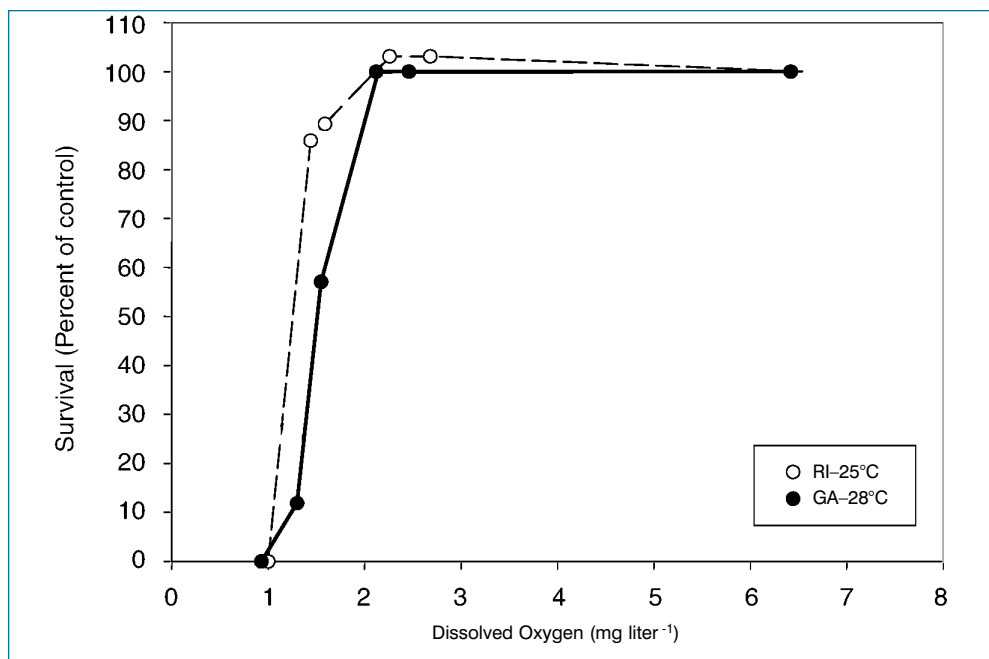
**Figure B-4.** Ninety-six hour dose-response for larvae of the Say mud crab *Dyspanopeus sayi* exposed to various levels of low dissolved oxygen. Open symbols are for tests conducted with populations from Rhode Island (RI) (one at 20°C, seven at 25°C, and one at 30°C). The closed circles are data for a population from Georgia (GA) conducted at 28°C. All of the Rhode Island data are from tests included in the Virginian Province saltwater dissolved oxygen criteria document and are listed in Poucher and Coiro (1997). Tests were initiated with larval animals ranging from stage 1 to stage 3 in development.

Source: U.S. EPA 2000.



**Figure B-5:** Ninety-six hour dose-response for larvae of the inland silverside *Menidia beryllina* exposed to various levels of low dissolved oxygen at two temperatures. Open circles are for a test conducted with a population from Rhode Island (RI) (25°C) and closed circles are for two tests with a population from Georgia (GA) conducted at 28°C. The Rhode Island data are from a test listed in Poucher and Coiro (1997). Tests were initiated with 7-day-old larvae.

Source: U.S. EPA 2000.



**Figure B-6:** Seventy-two hour dose-response for juveniles of the inland silverside *Menidia beryllina* exposed to various levels of low dissolved oxygen at two temperatures. Open circles are for a test conducted with a population from Rhode Island (RI) (25°C) and closed circles are for a test with a population from Georgia (GA) conducted at 28°C.

Source: U.S. EPA 2000.

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## LITERATURE CITED

Poucher, S. and L. Coiro. 1997. *Test Reports: Effects of Low Dissolved Oxygen on Saltwater Animals*. Memorandum to D. C. Miller. U. S. EPA, Atlantic Ecology Division, Narragansett, Rhode Island.

U.S. EPA 2000. *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras*. EPA-822-R-00-012. Office of Water, Office of Science and Technology, Washington, D.C. and Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division, Narragansett, Rhode Island.